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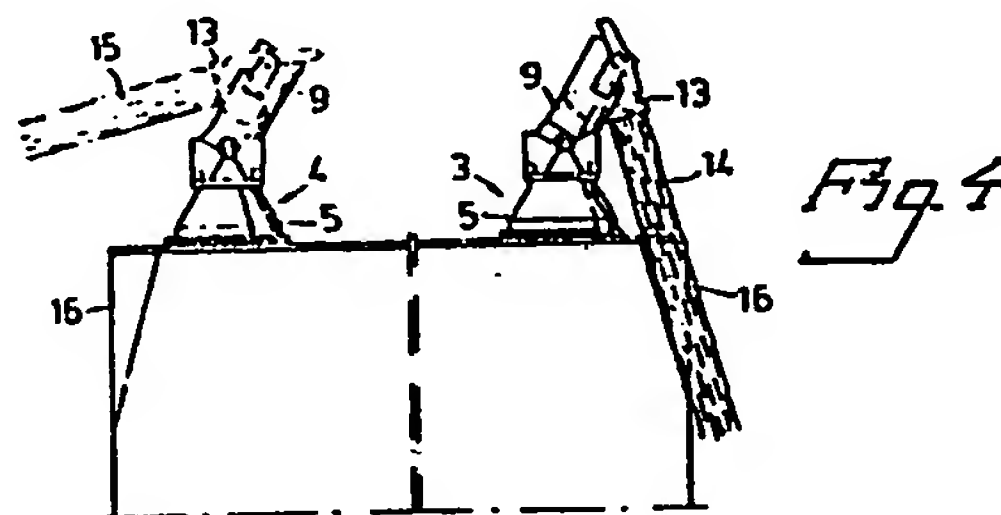
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(54) A Watercraft fitted with water-jet propulsion units, and a water-jet propulsion unit for watercraft.

(57) A watercraft is provided with at least two water-jet propulsion units (3,4) which are mounted in the stern part of the craft symmetrically on both sides of the centre line thereof. Each propulsion unit includes a pump having a pump housing (5) which incorporates an inlet opening connected to a water-supply channel (6) and an outlet opening located outwardly and rearwardly of a transom (1) of the craft. The outlet opening is connected to a tube (9) which can be pivoted about a vertical axis for directing the propelling water jet in a desired direction. The pivotable tube (9) carries a reversing device (13) which can be adjusted between an inactive and an active position and which, when occupying its active position, deflects the propelling water jet obliquely forwardly and towards the side of the craft remote from the centre line thereof, preferably in a substantially horizontal plane, so that the deflected water jet passes substantially outwardly of the near side of the hull of the craft.



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A watercraft fitted with water-jet propulsion units,
and a water-jet propulsion unit for watercraft.

The present invention relates to a watercraft fitted with water-jet propulsion unit, in accordance with the preamble of Claim 1, and to a water-jet propulsion unit for watercraft.

5 In principle a water-jet propulsion unit for watercraft comprises a pump, normally a propeller pump, mounted in a suitable location, normally in the after end of the craft, and connected to a water-supply conduit which extends
10 from an intake opening normally arranged in the bottom of the craft. The pump outlet is located externally of the hull of the watercraft, behind the transom, and is directed so that the jet of water generated by the pump leaves the outlet in a substantially straight, rearward direction, to propel the watercraft forwards. At the outer end
15 of the outlet externally of the hull there is normally arranged a pipe or tube which is connected to the outlet opening and can be swung about a substantially vertical axis, to change the direction of the propelling water jet for the purpose of steering the craft. In addition there
20 is normally arranged adjacent the outlet a reversing arrangement, in the form of a scoop or flap or like device for example, which can be swung into the path of the water jet, either in the fixed outlet channel or in the pivotable tube arranged rearwardly of the channel for steering the
25 watercraft, or immediately behind the outlet orifice of the tube, so as to deflect the water jet obliquely forwards, thereby to generate a reverse thrust for slowing down and/or reversing the craft.

30 In those water-jet propulsion units known hitherto the reversing device is so adapted that when occupying its active position the water jet is deflected downwardly and forwardly in a substantially vertical plane, so as to be directed beneath the bottom of the craft. This has certain disadvantages, which are particularly manifest in the
35 case of certain types of watercraft. For example, in this

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known arrangement the forwardly and obliquely downwardly directed water jet will pass close to the bottom of the craft and therewith in the near vicinity of the intake opening of the unit water-supply channel. Thus, quite an appreciable amount of this water jet will be drawn again into the water-supply channel and fed to the pump, meaning in reality that water will be recycled through the unit by the pump. As will be understood, this greatly reduces the reversing thrust generated by the unit and the thrust developed consequently falls beneath the level desired, so that the force acting on the craft to slow down and/or to reverse the same is smaller than desired. Although the level of reversing thrust developed under these circumstances will be fully sufficient in the case of many types of watercraft, other watercraft require the largest reversing thrust possible. This is particularly true of military landing craft for example, and also other watercraft with which it shall be possible to propel the craft onto a beach for unloading and/or loading purposes and then to reverse the craft off the beach. It will be understood that a considerable force is required to reverse the craft off the beach with the forward part of the craft resting thereupon, or in all events with the craft lying on the water bottom in the shallows adjacent the shore. When using a reversing device which is arranged in the aforescribed conventional manner, this reversing of a beached watercraft is made still more difficult by the fact that the obliquely downwardly and forwardly moving jet of water controlled by the reversing device will naturally give rise to an upwardly acting force which strives to lift the stern part of the craft, thereby to press the forward part of the craft harder against the beach or the water bottom. These disadvantages have cast great doubt on the usefulness of water-jet propulsion units for watercraft of this type, despite the fact that the use of such units is, per se, highly desirable because of the damage to which conventional propellers are often subjected with just this type of watercraft. In the case of watercraft used for military

purpos s, the use of water-jet propulsion units provid d
with reversing devic s construct d in the aforescrib d
manner also have the disadvantage that the downwardly and
forwardly directed water jets produced when the reversing
5 device is located in its active position entrain into the
water large quantities of air which create undesirable
disturbances and render the use of hydrophone equipment
onboard the craft difficult.

For the purpose of eliminating some of the afore-
10 mentioned disadvantages, it has been proposed in the art,
for example US Patent Specification 4,252,075, to design
the reversing device in a manner such that with the device
in its active state the water jet developed by the pump is
divided into two jets which are directed obliquely forwardly
15 symmetrically on respective sides of the jet pipe of the
unit. Although recycling of water through the unit is avoi-
ded with this arrangement, it is in itself encumbered with
a number of serious disadvantages. For example the two
water jets guided by the reversing device on respective
20 opposite sides of the jet pipe of the unit strike the transom
of the craft and therewith exert a forward thrust thereon,
which greatly reduces the total reversing thrust from the
unit. In the case of watercraft having a relatively low
transom, there is also a risk that considerable quantities
25 of water will be sprayed into the craft.

Accordingly, it is an object of the present invention
to provide a watercraft fitted with water-jet propulsion
units and being of the kind set forth in the preamble of
Claim 1, which is so constructed as to eliminate, or at
30 least greatly reduce, the aforesaid disadvantages and to
circumvent the drawbacks presented by the assembly described
and illustrated in the aforesaid U.S. Patent Specification
No. 4,252,075.

These objects are achieved in accordance with the
35 invention in that the reversing devic of each of the two
water-jet units is so formed and arranged on the pivotable
tube that when a r spective device occupies its active
state the propelling water jet is defl cted obliquely

forwards towards that side of the craft remot from the centr line thereof, such that said deflect d water jet passes substantially outwardly of that side of the craft hull adjacent the unit.

5 Other advantageous characteristic features of a watercraft and a water-jet propulsion unit according to the invention will be apparent from the following claims.

The invention will now be described in more detail with reference to an embodiment thereof illustrated in the
0 accompanying drawings, in which

Figure 1 illustrates schematically the stern part of a watercraft from above and partially in section, this partial sectional view being taken on the line I-I in Fig. 2;

5 Figure 2 is a schematic sectional side view of the stern part of the watercraft, taken on the line II-II in Fig. 1; and

Figures 3, 4 and 5 illustrate ~~schematically~~ from above the stern part of the watercraft with the reversing devices
of respective water-jet propulsion units shown in their active states.

Figs. 1 and 2 illustrate schematically the stern part of a watercraft, including a transom 1 and bottom 2. The illustrated craft is provided with two jet propulsion units,
generally referenced 3 and 4, which are mounted in the stern symmetrically on both sides of the centre line of the craft. Each of the jet propulsion units includes a propeller pump having a pump housing 5 which is so mounted in the transom
1 that the inlet to the pump housing 5 is located within the hull of the vessel, while the outlet opening from the pump housing is located externally of the transom 1 and is pointed in a substantially straight and rearward direction. Connected to the inlet of the pump housing 5 is a water supply channel 6 which extends from a water intake 7 in
the bottom 2 of the craft. The pump impeller in the pump housing 5 is driven by a shaft 8 from a drive machine (not shown) mounted within the craft. Connected to the outlet opening of the pump housing 5 is a pipe or tube 9 which can

b swung by means of piston-cylinder devices 10 about a substantially vertical axis 11 in a manner to direct the water jet exiting from the outlet opening of the pump housing 5 in a manner to steer the craft in different directions.

In the aforescribed respects the illustrated jet propulsion units are of previously known construction. These jet propulsion units are described more clearly in, for example, Swedish Patent Specification 424 845. Many other embodiments of jet propulsion units of a similar kind are known to the art. It will be understood that the two jet propulsion units 3 and 4 mounted on the watercraft illustrated by way of example in the drawing are constructed in mutually the same manner in the aforescribed respects.

It is previously known, and normal practice to provide such jet propulsion units with a reversing device by means of which the propelling water jets, which are directed substantially rearwardly during normal operation of the craft, can be deflected so as to be directed substantially forwardly, when seen in the normal direction of movement of the craft, so that the craft can be slowed down and reversed. This reversing device may have a number of different forms, and may comprise, for example, a scoop-like member or a flap or some like device arranged for movement from an inactive position to an active position in which it is located in the path of the water jet, so as to deflect the jet to a substantially forward direction. The reversing device is normally mounted on the pivotable steering tube so that deflection of the jet is effected in the tube or immediately behind the rearward outlet orifice thereof, thereby enabling the tube to be used for steering the craft even when moving astern. As beforementioned, when a conventional, known reversing device occupies its active state the water jet is normally deflected obliquely downwardly and forwardly, i.e. in a substantially vertical plane, so that the water jet passes down beneath the bottom of the craft.

In the water-jet propulsion unit according to the present invention, however, the reversing device is so

designed that when occupying its active state the water jet is deflected obliquely forwardly and towards the side remote from the centre line of the craft, so that the deflected water-jet passes substantially outwardly of the near side of the hull of the craft. In the illustrated embodiment of the invention, each reversing device of respective propulsion units 3 and 4 comprises a scoop-like element 13 which can be swung into the tube 9 by means of a hydraulic piston-cylinder device 12 and which is arranged on the side of the tube 9 remote from the centre line of the craft, in a manner such that with the reversing device in its active state the water jet is deflected obliquely forwardly in a substantially horizontal plane, away from the aforesaid centre line. Thus, when reversing or moving the vessel astern, the water jets 14, 15 deflected by the reversing scoops 13 and issuing from the tube propulsion units 3, 4 are directed obliquely outwardly and forwardly on respective sides of the craft, as illustrated schematically in Fig. 3.

A watercraft reversing device of this design affords the advantages discussed in the foregoing, namely that water will not be recycled through the propulsion unit when reversing the craft, with subsequent reduction in the propelling force, and neither will the stern end of the craft be subjected to lifting forces. In addition, substantially no air will be drawn down into the water around the craft. The water jets will also pass outwardly of the hull on both sides of the craft, so as not to strike the transom thereof or to cause water to be sprayed thereinto to any appreciable extent.

When the reversing devices 13 are mounted on the pivotable tubes 9 used to steer the craft, there is afforded the additional advantages that, as illustrated in Fig. 4, the water jets 14 and 15 deflected by the reversing devices 13 and issuing from the two jet propulsion units 3 and 4 may be directed in mutually different directions by pivoting the tubes 9. In this case, the craft is not solely subjected to a rearwardly acting force but also to a rotary or torsional force, by means of which the craft can be swung or

"twisted" free from a beach. By swinging the tubes 9 of the two jet propulsion units 3,4 in mutually opposite directions it is also possible to direct the deflected water jets issuing from the two units substantially parallel with the longitudinal axis of the craft, as illustrated in Fig. 5, thereby to exert a still greater rearward thrust on the craft.

If desired, the sides of the hull at the stern part of the craft may be provided with cavities or recesses 16 operative in allowing the water jets to pass in this position.

It will be understood from the foregoing that many other embodiments and modifications are possible within the scope of the invention, particularly with respect to the structural design of the reversing devices. Although the reversing devices of the illustrated embodiment are shown to direct the water jets in a substantially horizontal plane, this is not an absolute requisite of the invention, since the primary intention is to direct the water jets to one side and away from the centre line of the craft, so that the jets pass outwardly of the sides of the hull.

CLAIMS

1. A watercraft provided with at least two water-jet propulsion units (3,4) mounted on the stern part of the craft symmetrically on both sides of the centre line thereof, each unit (3,4) including a pump and a pump housing (5) having an inlet opening connected to a water-supply channel (6) and an outlet opening located externally of and rearwardly of a transom (1) of the craft, to which outlet opening there is connected a tube (9) which can be pivoted about a substantially vertical axis to direct a propelling water jet issuing through said outlet opening in a selected direction, and a reversing device (13) mounted on said tube (9) and arranged for movement between an inactive and active position for deflecting said water jet obliquely forwardly in relation to the craft, characterized in that the reversing device (13) of each unit (3,4) is so formed and arranged on the pivotable tube (9) that when the reversing device occupies its active position the propelling water jet is directed obliquely forwards and towards the side remote from the centre line of the craft, so that the deflected water jet (14,15) passes substantially outwardly of the side of the craft hull adjacent the unit.

2. A watercraft according to Claim 1, characterized in that the sides of the hull in the vicinity of the stern part of the craft are provided with recesses (16) operative in allowing the water jets (14,15) deflected by the reversing devices (13) of the two units (3,4) to pass by.

3. A watercraft water-jet propulsion unit comprising a pump having a pump housing (5) with an inlet opening for connection to a water-supply channel (6) and an outlet opening to which there is connected a tube (9) which can be pivoted about a substantially vertical axis for directing a propelling water jet issuing from the outlet opening in a selected direction, and a reversing device (13) mounted on said tube (9) and capable of being adjusted between an inactive and an active position so as to deflect the water jet obliquely forwardly as seen in the normal propelling

direction of the unit, characterized in that the reversing device (13) is so formed and mounted on the pivotable tube (9) that in the active position of the device the water jet is deflected obliquely forwardly and laterally on solely one side of the pivotable tube (9).

4. A water-jet propulsion unit according to Claim 3, characterized in that when occupying its active position the reversing device (13) deflects the water jet obliquely forwardly and laterally in a substantially horizontal plane.

Fig. 1

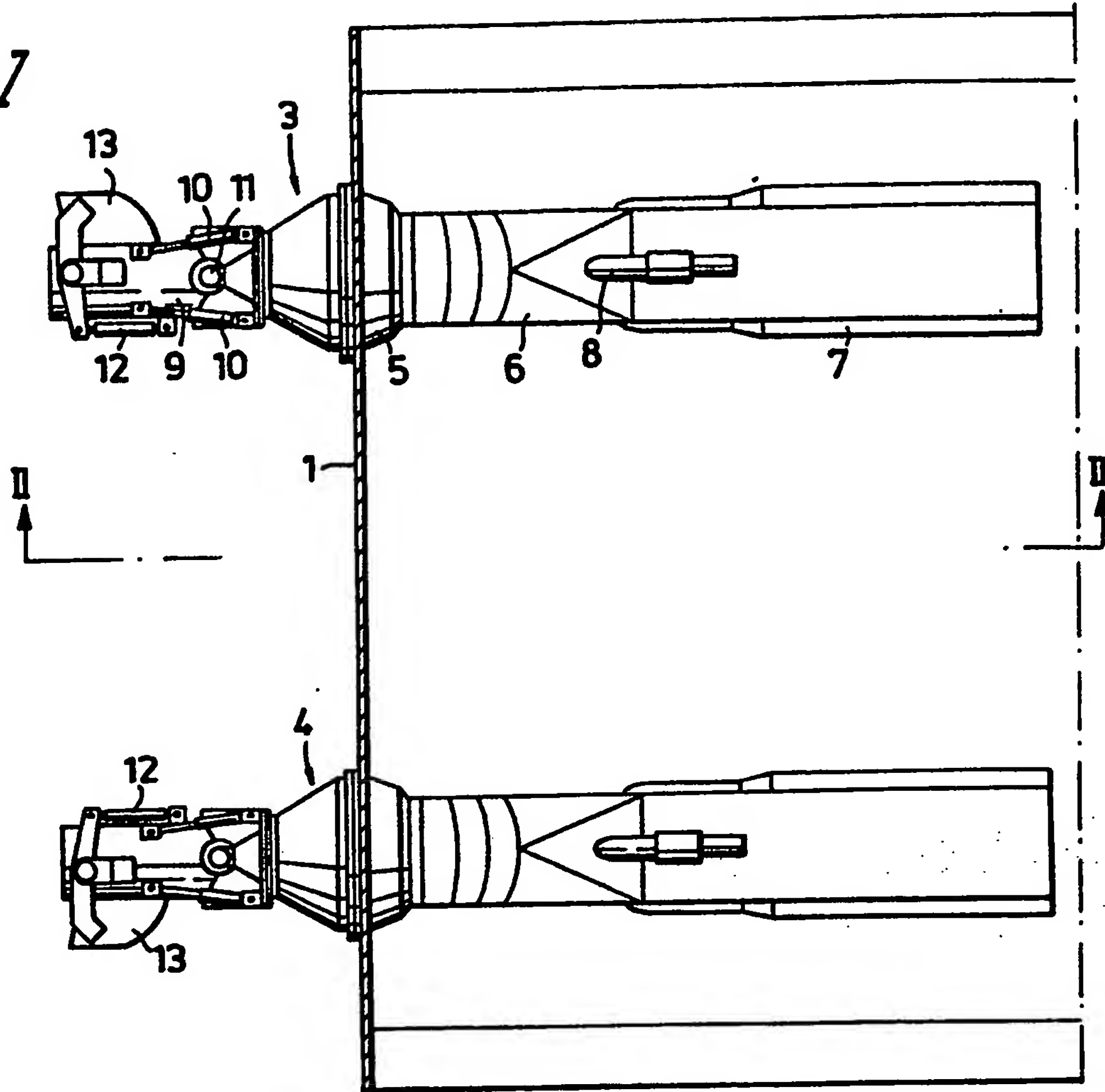


Fig. 2

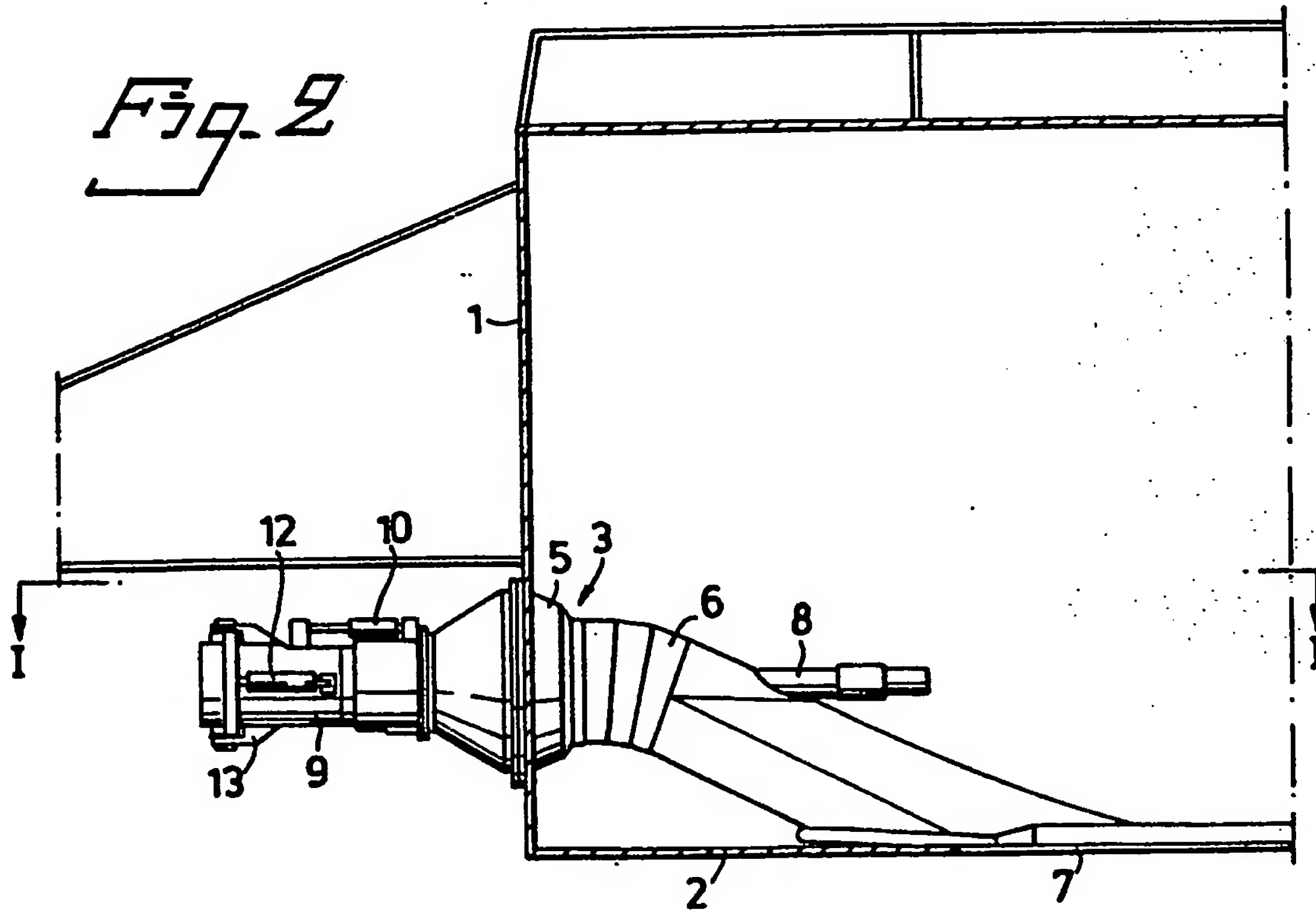


Fig. 3

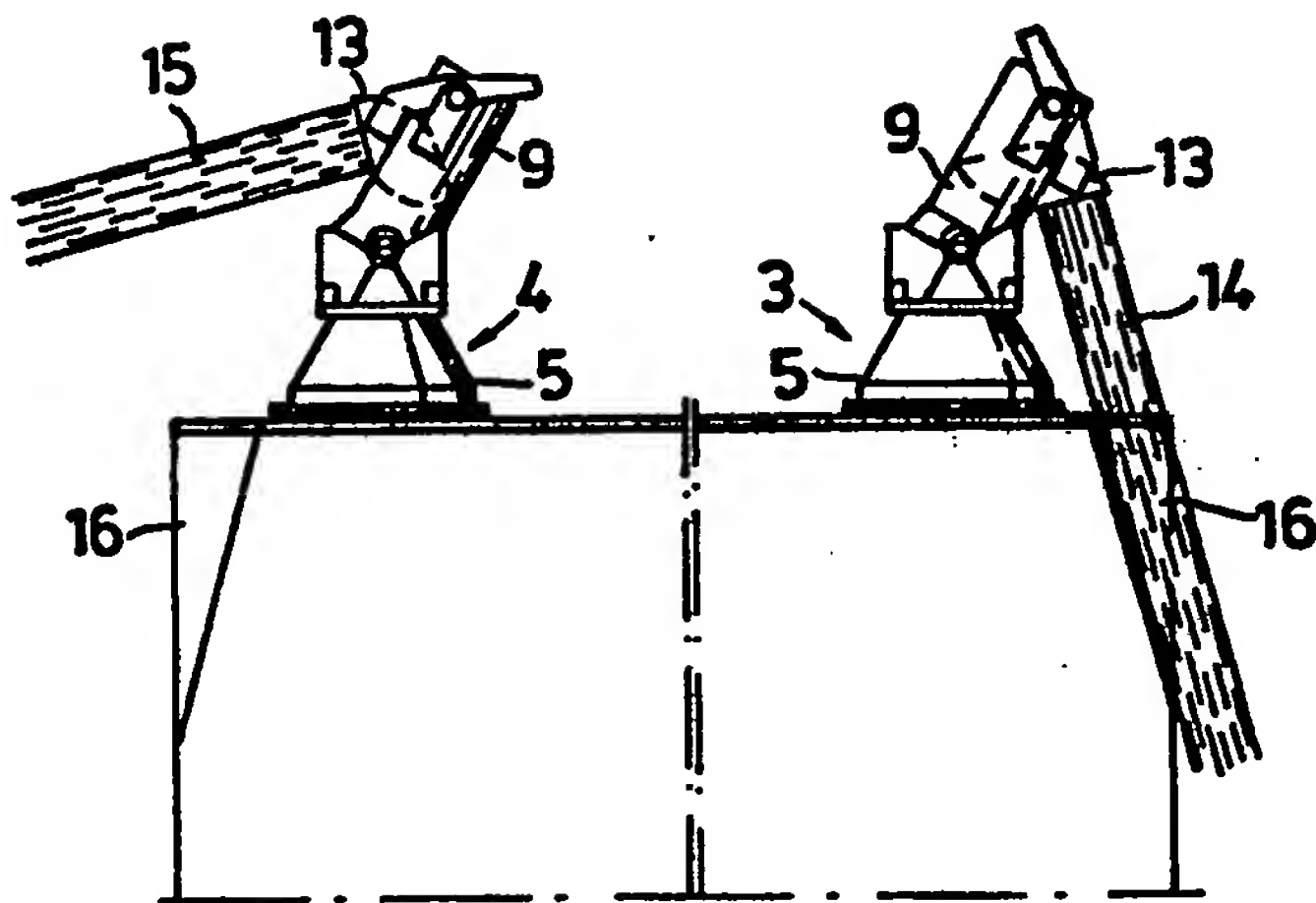
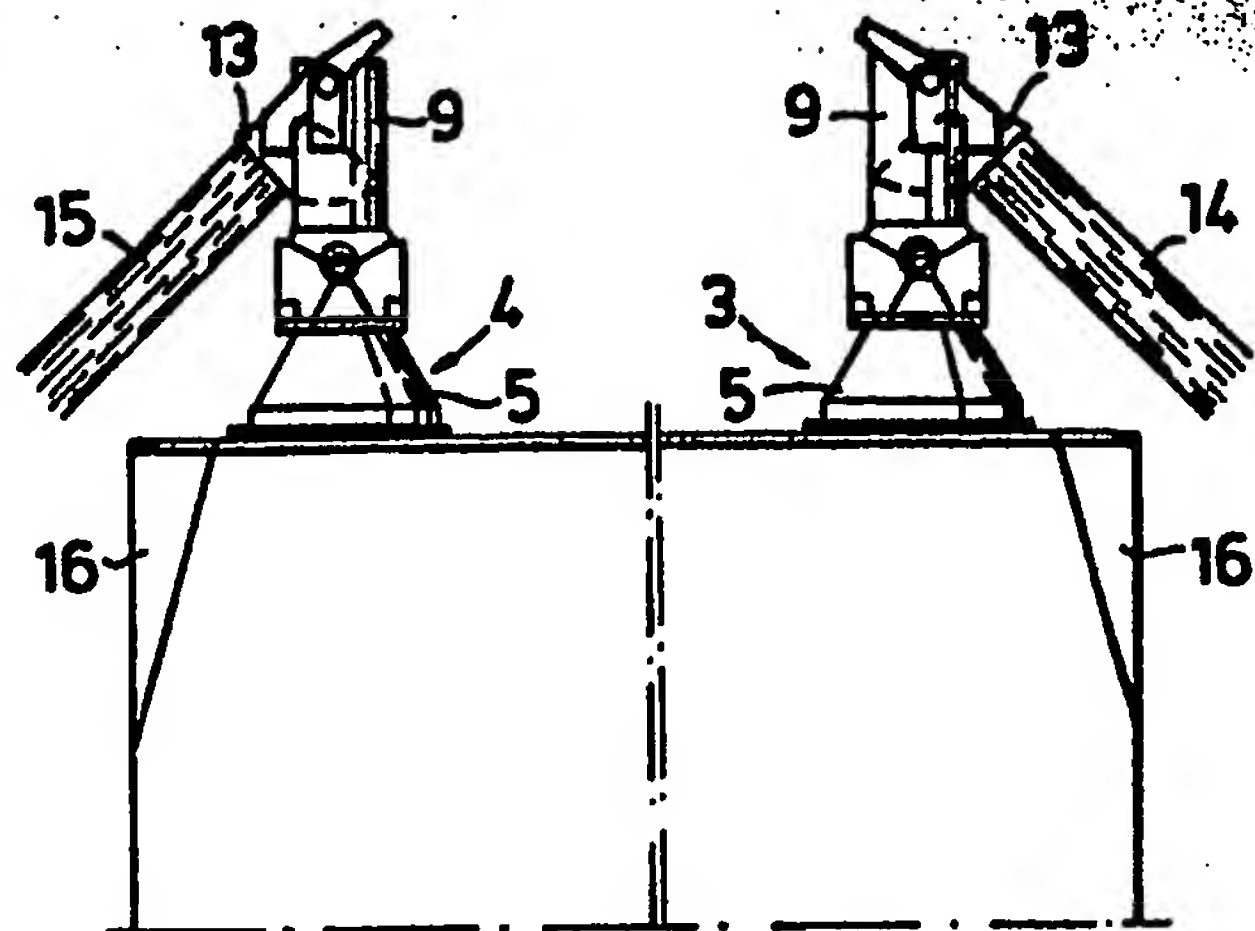
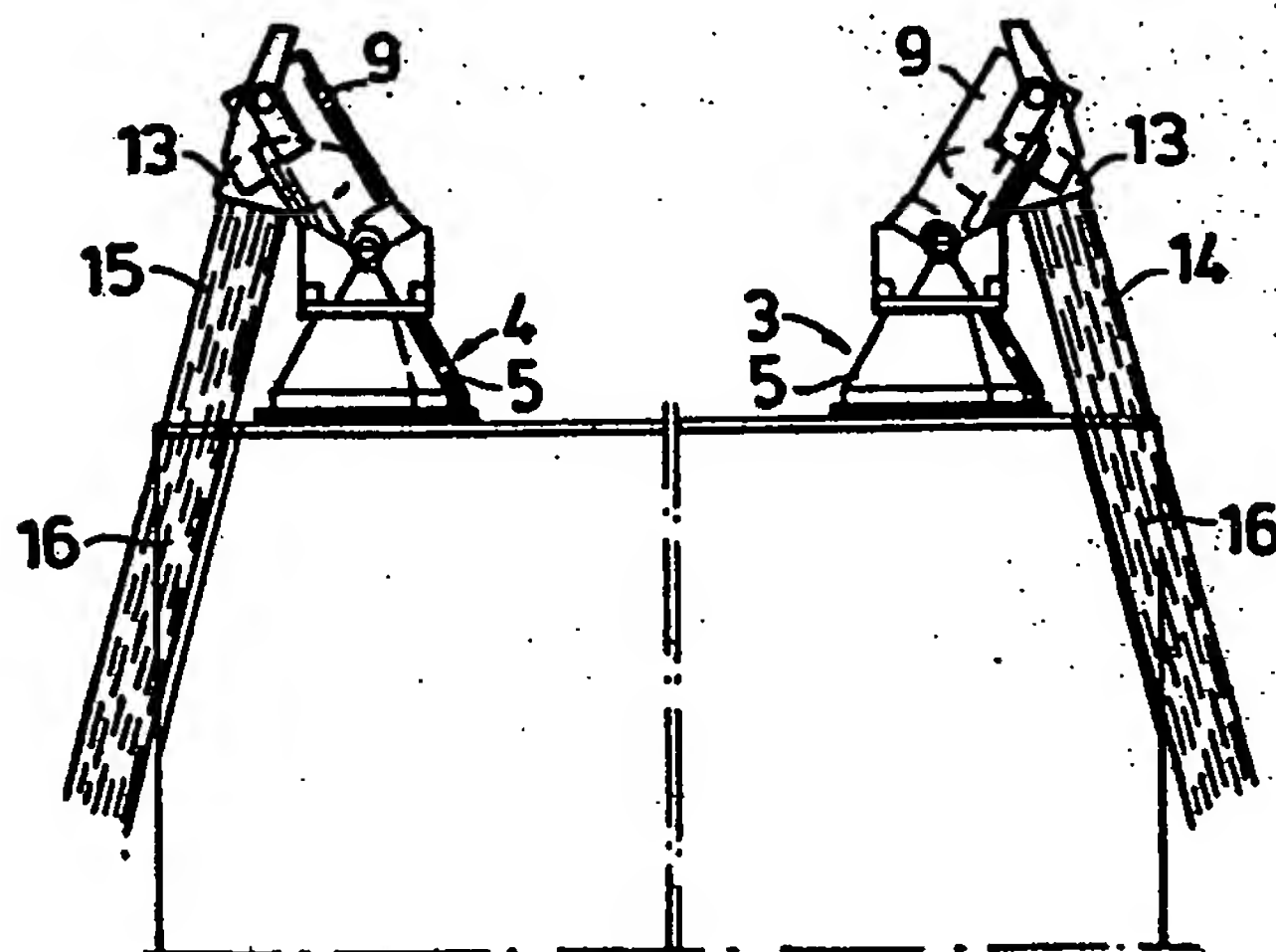


Fig. 4

Fig. 5





European Patent
Office

EUROPEAN SEARCH REPORT

0201657

Application number

EP 85 85 0164

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|--|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl. 4) |
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| D,A | US-A-4 252 075 (YOSHIKI KOBAYASHI) * Columns 1-4; figures 2A-3B * | 1,2 | |
| A | US-A-3 756 185 (BRESLIN) * Whole document * | 1,2 | |
| A | GB-A-1 325 815 (TWIN DISC INC.) * Figures 1,4 * | 2 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl. 4) |
| | | | B 63 H |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 31-01-1986 | Examiner VOLLERING J.P.G. |
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